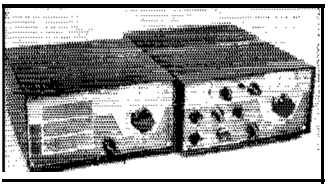
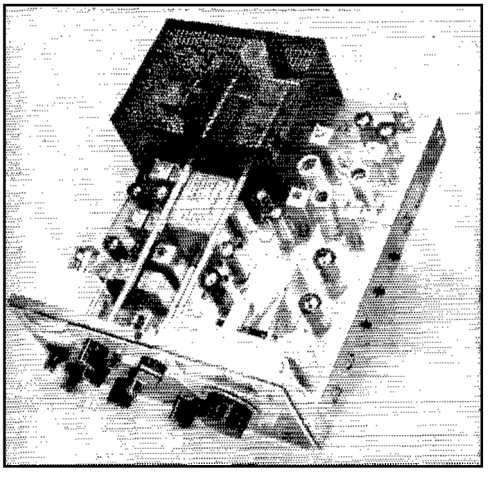
Drake TR-4 Transceiver



The popularity of transceivers continues to increase, and with the growth of this packaged-equipment market come advancements in circuitry packaging, and over-all performance. Notable among the list of new transceiver units is the Drake TR-4 superseding the popular Drake TR-3 transceiver offering a healthy 300 watts p.e.p. input on s.s.b. the newest member of the Drake family operates on the 80-, 40-, 20-, 15-, and 10-meter bands. In addition to the s.s.b. mode, a.m. and c.w. operation are available at the flip of a switch at a power input level of 260 watts. A solid-state v.f.o. is included in the package contributing to the general compactness of the TR-4

Transmitter Section

A block diagram of the TR-4 is shown in Fig. 1. Because of the transceiver configuration, some of the tubes serve for both receiving and transmitting. The changeover from transmit to receive is accomplished with a relay activated by the VOX or push-to-talk circuits.



A top-chassis view of the Drake TR-4 transceiver. The p.a. tubes and tank circuit ore contained in the metal cage at the left rear of the chassis. The permeability-tuned v.f.o is housed in the metal con in the right foreground. The microphone, key, and headphone jacks ore located along the right side of the chassis and ore adjacent to the VOX control shafts.

When in the transmit mode, audio from the microphone is supplied to V18A where it is amplified and passed on to V18B and amplified further. The a.f. energy is then fed to the balanced modulator (Fig. 2) where it is mixed with a 9-Mc. signal from the carrier generator, V16. The resulting suppressed-carrier d.s.b. energy (when operating on s.s.b.) is taken from the balanced modulator and amplified by V15 prior to being passed along to the 9-Mc. cystal-filter circuit. Upper or lower sideband is selected by switching the appropriate 9-Mc. filter into the circuit, as show in Fig. 1. The bandpass characteristics of the filters permit, a single 9-Mc. carrier oscillator to furnish a b.f.o. signal which is placed at the proper point on the filter's selectivity curve When receiving The carrier is positioned in the same place when transmitting s.s.b., making it possible to select either upper or lower sideband without changing the carrier frequency. During c.w. operation the carrier is shifted to a point that is higher on the selectivity curve.

Output from the 9-Mc. filter is supplied to the transmitting mixer, V4, the latter receiving the appropriate mixing signal from the cathode follower V3A. V3A is supplied with energy either from converter V1, which is crystal controlled, or directly from the transistor v.f.o.-buffer section, depending upon the frequency of operation. The v.f.o.'s 4.9-5.5-Mc. energy is fed directly into V3A during operation on 80 and 20 meters. On the remaininig bands the v.f.o. signal is beat against crystal-controlled frequencies generated in the Converter stage, V1, in each case producing an output which. when mixed with 9 Mc. in V4, will result in the desired final output frequency. Following the mixing process, the output of V4 is applied to the 12BY7A driver stage, V6, where It is amplified nnd passed on to the grids of three parallel-connected 6JB6 tubes in the p.a. stage. 'Thc p.a. output tank employs a pi network designed to match a nominal 50-ohm load.

The TR-4 has an effective a.1.c. circuit (Fig, 3) which serves to maintain a high average talk-power level while preventing "flat topping" of the transmitted signal. The p.a. stage is operated Class AB1 and under normal conditions there is no grid-current flow. When too much drive reaches the p.a. grid circuit. grid current flows, reducing the negative bias between grid and

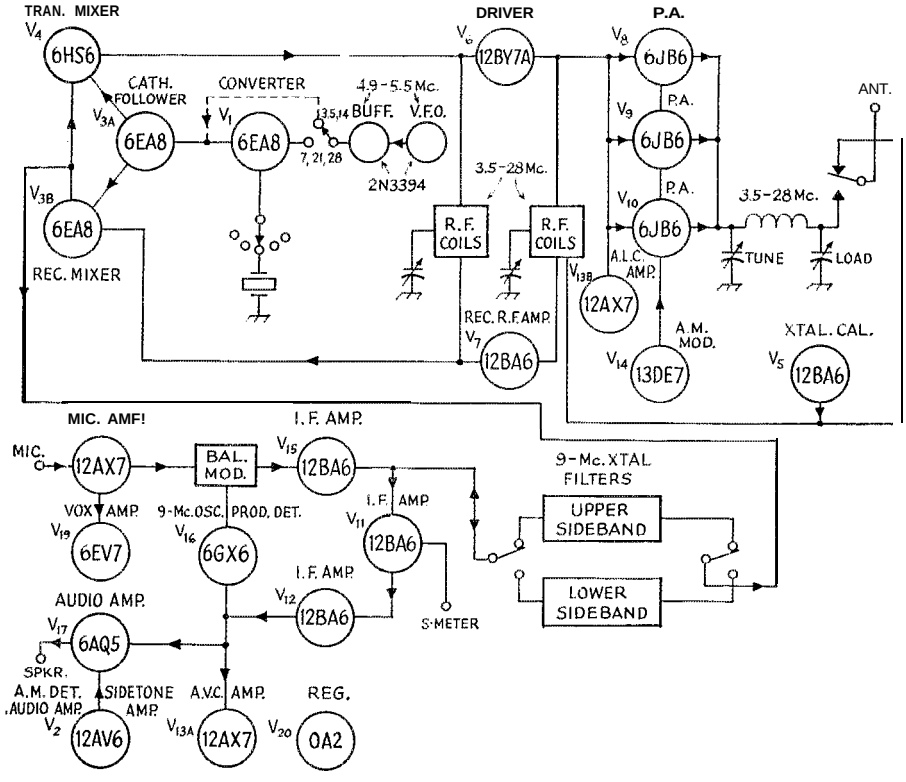


Fig. 1-Block diagram of the Drake transceiver. The arrows indicate the signal's path as it travels through the circuit. The means by which upper and lower sideband selection is accomplished is shown in the diagram.

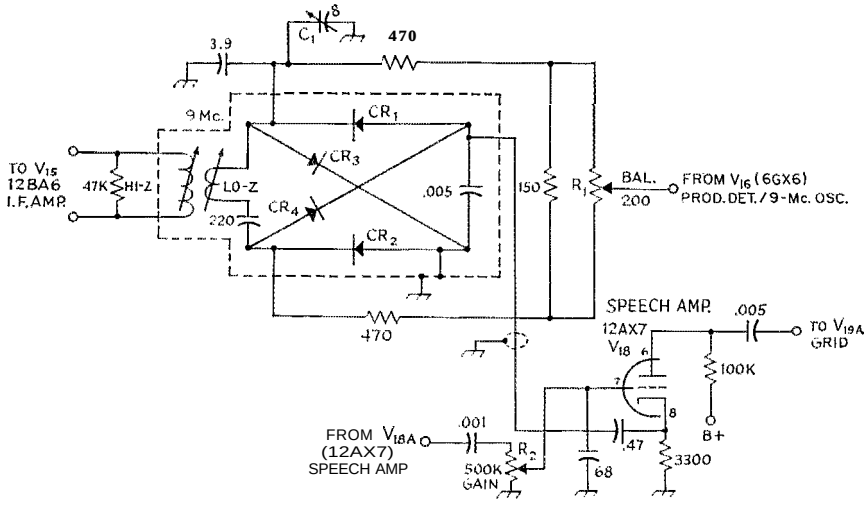


Fig. 2-Details of the balanced modulator used in the TR-4. CR1 through CR4 ore matched pairs of 1N270 diodes. CR1 and CR2 are matched as one CR3 and CR4. low-impedance audio input is supplied by the cathode-follower arrangement at V18. R.f. balance is accomplished by C1 while d.c. balance is effected by R1.

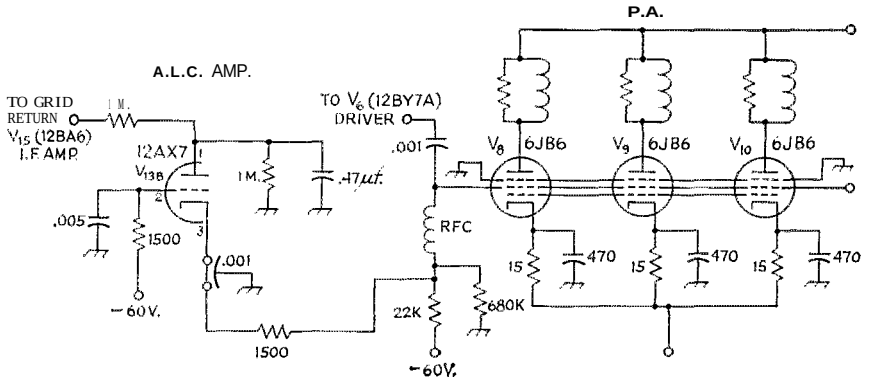
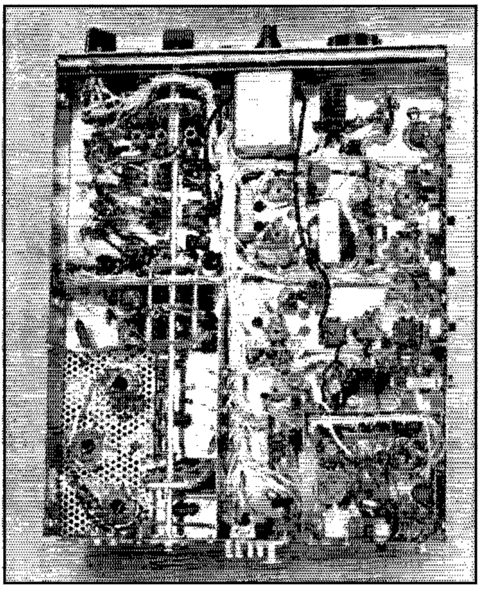


Fig. 3-A somewhat novel approach to a.l.c. is illustrated in this diagram. One half of a 12AX7 tube is used to amplify changes in p.a. grid current, in turn permitting varying amounts of negative voltage to be applied to the control grid of i.f. amplifier tube V15. The higher the p.a. grid current, the greater the negative voltage that reaches V15, thus reducing V15's output and in turn lowering the excitation to the p.a. grids.

cathode of the a.l.c. control tube, V13B. This in turn increases the voltage across thr 1-megohm resistor in V13B's plate circuit (negative to ground), which is also the grid-return circuit of i.f. amplifier tube, V15. The increased negative bias voltage on the grid of V15 reduces the output of that stage, in turn reducin g the drive to the p.a. grid circuit.

During c.w. operation V2 becomes an audio phase-shift oscillator which is grid-block keyed along with the transmitting mixer, V4, and the driver stage, V6. Audio output from V2 is applied to the grid of the product, detector tube, V16, through the sidetone control to provide audio output from the speaker for C.W. monitoring, and to the grid of the VOX amplifier tube. V19A, operating the control relays in the TR-4 The relays turn on the transmitter, cause the 9-Mc. oscillator to be shifted to 9.001 Mc. and apply a variable d.c. voltage source (through one section of the transmitter gain control) to the balanced modulator, unbalancing it so that carrier injection will occur.

During a.m. operation, the screen modulator tube, V14, is connected to the p.a. screen-grid circuit and a fired-value voltage is applied to the balanced modulator unbalancing it. As is the case with c.w. operat ion, the 9-Mc. oscillator is shifted to 9.001 Mc. The operator may select VOX or push-to-talk operation while using the a.m. mode.



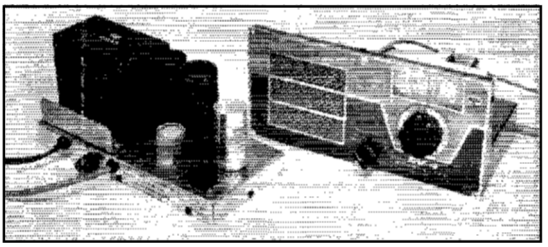
Under-chassis view of the TR-4 transceiver. The accessory plug for the RV-4 is visible adjacent to the front panel and near the side of the chassis containing the VOX controls. Circuit isolation between the p.a. stage and the balance of the circuit is effected by means of power-lead filtering mode possible by bringing the wiring into the p.a. compartment via feedthrough capacitors.

The Receiver Section

The incoming signal from the antenna is routed to the r.f. amplifier tube, V7, through the changeover relay in the TR-4. The amplified signal is passed on to the receiving mixer, V3B, whereit is combined with the appropriate injection signal from V3A to produce the required 9-Mc. i.f. The 9-Mc. i.f. energy is fed into either of the two crystal filters. depending upon whether upper or lower sideband is to he received (Fig. 1). After leaving the filter the 9-Mc. signal is amplified by tubes V11 and V12 and then fed into the a.g.c. amplifier, V13 A, while at the same time beingapplied either to t he input circuit of the product detector, V16, for s.s.b. reception or to the diode detector in V2 for a.m. reception. A 9-Mc. b.f.o. signal is generated by V16. The audio output level from V16 is sufficient to be fed directly to the audio output tube, V17, without additional amplification.

Additional Remarks

The TR-4 is designed to operate from an a.c. power supply (AC-3) or from a 12-volt d.c. power supply (D C-3) , making it convenient to operate from either a fixed station or from a mobile setup.



The RV-4 remote v.f.o. and AC-3 power-supply unit are shown removed from their cabinet. The RV-4 is discussed in the text.

An accessory item, the RV-4, is an external v.f.o. which can be plugged into the TR-4 and used to control either the transmitting or receiving frequency, or both, within the same band independently of the v.f.o. setting in the TR-4. The desired combinations of the two v.f.o.s can be selected at will by means of a switch. The separate frequency control is especially convenient for tuning the band without disturbing the TR-4's v.f.o., which may be left on a selected transmitting and receiving frequency for schedules, net operation, and so forth. Similarly, the RV-4 offers flexibility in receiver tuning when operating c.w., permitting stations on slightly different frequencies to communicate without "walking" across the band - a common occurrence when both stations are using transceivers. The separate v.f.o. is equally useful on s.s.b. for working foreign stations on frequencies outside the U.S. phone assignments. The RV-4 cabinet contains the speaker and power supply for the TR-4, contributing to a neat, compact installation.

Other Features

Equipment servicing and circuit adjustment are simplified by rapid removal of either the top or bottom halves of the TR-4 cabinet. By removing 6 screws, the top section of the cabinet can be lifted off, exposing the top of the chassis. Similarly, the bottom portion of the enclosure can be removed, making the under chassis of the TR-4 available. The panel-chassis assembly remains intact at all times.

One blessing that is included with the TR-4 package is that all interconnecting cables, plus the key and microphone plugs, are shipped with the unit. This is a special convenience if one has a key or microphone that is equipped with fittings of a different style.

The illuminated dial plate is calibrated in 10-kc. increments and is supplemented by 1-kc. calibration marks on the skirt of the tuning knob. The built-in crystal calibrator aids in rapid mechanical calibration of the two dial mechanisms when moving from one band to another. A feature that some manufacturers overlook can be noted in the photographs — the main tuning dial is well removed from the other controls on the panel, making tuning of the v.f.o. possible without becoming entangled in the other panel controls. The remainder of the controls are easily accessible but are a bit difficult to identify by their panel markings under ordinary lighting conditions. This results from a rather low contrast between the color of the panel and that of the lettering. After it few hours of use the panel layout becomes memorized, making the readability of the labels less significant.

The instruction book is very complete and is worded in terms that are easily understood. A step-by-step explanation of how the circuit works is included in the manual, plus tune-up and troubleshooting information. The schematic diagram, although somewhat complex, is easy to follow because of its 2-page size. It would bo somewhat easier to identify the various stage of the transceiver, however, if the function of each tube had been printed on the diagram along with the V numbers.

A 2-scale meter is located on the front panel. enabling the operator to read p.a. plate current, transmitter a.g.c. voltage, relative r.f. output when transmitting, and S units while receiving. Each S unit equals approximately 5 decibels and S9 equals about 30 microvolts.

The a.l.c. circuit shown in Fig. 3 performs effectively. During on-the-air use of the equipment., an attempt was made to overdrive the p.a. stage by turning the transmitter gain control fully clockwise. The signal quality remained good despite the fact that household sounds became almost as audible as the operator's voice.

The TR-4 was used to excite a 1-kw. linear amplifier and performed as well as it did in the "barefoot" mode. A spare set of relay contacts is connected to the power plug in the TR-4, making it possible to control an external relay such as tnight be contained in an outboard linear amplifier.

An MMK-3 bracket assembly is available to TR-4 users, permitting them to mount the transceiver under the dashboard when the TR-4 is used in a mobile installation. -- W1CER

Drake TR-4 Transceiver

Height: 5 1/2 inches.
Width: 10 3/4 inches.
Depth: 1 3/8 inches.
Power requirements: 650 volts d.c., 500 ma.; 250 volts d.c., 175 ma., -45 to -65 volts d.c., 35 ma.; 12.6 volts a.c./d.c. at 5.5 amp.
Price class: $550-600.
Manufacturer: R. L. Drake Co., Miamisburg, Ohio.